DOCUMENT RESUME

ED 255 263 JC 850 132

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TITLE Mathematics Laboratory Focus, Fall, 1985.
INSTITUTION Somerset County Coll., Somerville, NJ.
PUB DATE [84]
NOTE 16p.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Budgeting; Community Colleges; *Individualized Instruction; *Mathematics Instruction; *Program Costs; *Remedial Mathematics; *Tutorial Programs; Two Year Colleges
IDENTIFIERS *Mathematics Laboratories

ABSTRACT

Procedures to be followed in the development of a mathematics laboratory at Somerset County College are presented in this paper. Introductory material outlines the advantages of a laboratory setting in independent and self-directed study; and highlights the two basic characteristics of successful lab programs (i.e., their comprehensiveness in terms of support services and their institutionalization into the academic and social mainstream of the college). This section also stresses the need for standardization of teaching and evaluation practices. Next, the functions of the mathematics laboratory are articulated in the areas of basic skills instruction, which is self-paced and study-oriented and is offered via audio/videotapes, tutors, and computer-assisted instruction; and an open walk-in laboratory to serve the dual purpose of basic skills classroom and "open tutorial" laboratory for students with math problems. The next sections focus on the budget for math lab personnel; balancing the tutor budget for the 1985-86 academic year; and the equipment and instructional material needs of the lab for 1985-86, including printed medium, audio-visual components, and furniture. Outlined also are types of handouts available concerning procedures for tutors, test taking, audio-visual equipment, and administrative procedures. Appendices include flow charts and a teacher questionnaire. (HB)

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MATHEMATICS LABORATORY FOCUS

FALL, 1985

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MATHEMATICS LABORATORY FOCUS
FALL, 1985

By: Joan Capps
Math Laboratory
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The following analysis of the procedures to be followed in order to effect a successful Mathematics Laboratory in the Fall, 1985 semester is based on the philosophy that students must be given a chance to learn in different ways, to have their own successes and to grow in self-confidence as they assume responsibility for their own learning. The Mathematics Laboratory proposed is the environment that provides the opportunity for this independent and self-directed study.

The steps outlined assume the use of the Laboratory as a model that facilitates competency-based education and that responds to large numbers of students - not solely students enrolled in Basic Skills classes. With individualized instruction and sequential learning modules, the lab serves as a repository for audio/video tapes and computer software used in the department's classes and available for students to review.

Plans support the concept that the Math Laboratory should grow into a department test-library-center. The Lab should be innovative in serving large numbers of students without the artificial restriction of scheduling. Thus, the "Open-Lab" and "Variable Credit" concepts are presented in an embryonic stage with growth anticipated. The Open-Lab concept in Mathematics learning has been shown to increase retention and thus increase the number of graduates from the Mathematics program.

The plans presented encompass the concept that successful laboratory programs have two broad characteristics: 1) comprehensiveness in their support services and 2) institutionalization into the academic and social mainstream. By the latter I mean that the Mathematics Laboratory is not perceived as a separate, isolated remedial component with the "you cure them" mentality.

The Lab has a growth potential of becoming a highly visible testing ground for innovation efforts in learning improvement that maintains a close working relationship with all academic areas. In this way, the Math Lab is perceived as a support service that facilitates comprehensive course designs that integrate the development of basic skills into the regular college course content.

As a result, any plan presented for Mathematics Laboratory development MUST address the Basic Skills course design and MUST introduce standardization of teaching/evaluation practices. Teacher individuality in a laboratory approach is expressed not in course development but in the management of the system of components.

I Mathematics Laboratory Functions, Fall, 1985

A. Basic Skills

The classes handled in the Mathematics Laboratory differ from traditional mathematics classes in that there are no set lecture periods. The student enrolled in Arithmetic/Algebra comes to the Laboratory regularly (3 hours per week, Fall 1985) and works individually at his/her own pace. All students follow the pattern as indicated on the flow chart shown in the Appendix.

Following are suggestions for the improvement of curriculum making use of laboratory facilities.

1. All study-guide units should contain video/CAI study activities worked by the student before the Mastery Test is taken.

2. All practice units should be CAI study-oriented.

3. All review units should be audio/video study-oriented.

The student is encouraged to study in the Lab where help is available to him/her via audio/video tapes, tutors, and CAI if he/she runs into difficulty. All work is checked immediately in the student's presence. Errors on tests and study activities are always explained by the instructor or tutor as soon as the work is completed by the student.

If a student wishes to spend more than his/her scheduled time in the Lab, he/she is encouraged to do so. The only limitation that should be placed on extra attendance is that the student relinquish his/her place when a scheduled student does not have access to Lab facilities due to overcrowded conditions. Students are allowed to change their scheduled time if they have isolated job commitments that make the scheduled time a hardship. Since all files are centralized in the Math Lab and all work and grading

procedures are standardized, schedule changes are acceptable. Time limitations are indicated by the clerk as the student enters the lab by color-coded cards which are placed on the table (carrel) beside the student. A time clock is available to record the student's extra attendance. Basic Skills class teachers could use the time clock to facilitate classroom attendance taking.

Instructors teaching in the Math Lab are alert to modern learning strategies, recognizing that self-paced, individualized study has the danger of addressing algorithmic learning solely. Heuristics are introduced by group discussion/lectures initiated by students, tutors and instructors whenever appropriate.

An instructor or tutor never sits at a desk and waits for questions; but, as an efficient manager, seeks out a student's problem as learning is occurring. If the problem is academic, the student should be directed to the Lab's academic components; if the problem is in learning or study skills, the student should be directed to counseling or to learning programs designed to implement known learning/retention strategies.

It should be emphasized that every instructor who knows mathematics is not an effective Basic Skills (Open Math Lab) instructor. Every instructor who teaches in the Laboratory should have a philosophy and style that supports the Personalized System of Instruction, the team approach of the Lab personnel, and be able to function effectively in a multi-component setting. Thus, orientation and monthly meetings should be held to insure adherence to Math Lab policies. See PSI Questionnaire in Appendix.

B. Open Walk-In Laboratory

In the Fall, 1985 semester, the Mathematics Laboratory will serve the dual purpose of classroom for Basic Skills classes and "Open-Tutorial Lab" for students in mathematics and math-related courses who seek assistance with problem areas. These dual functions are compatible since the availability of technological tutoring aids (audio, video, CAI) will decrease the time needed for the continual assistance of a tutor. However, at "peak hours", two Math tutors should be assigned to the Math Lab - one for Basic Skills class assistance and one for the "Open Lab". A clerk (preferably from Financial Aid) must be available at all times. The

clerk takes care of software/hardware distribution, attendance, and all records necessary for the efficient running of the Laboratory. In most successful laboratories, the clerk grades and records tests so that the faculty member is free to diagnose exams and prescribe varying remedies to overcome mathematical weaknesses.

Students who are registered in classes which require Math Lab work outside the regular classroom setting must punch a time clock to record attendance. The only limitation on these students is that they must relinquish their places after 1 hour when overcrowded conditions exist.

C. Budget for Mathematics Laboratory Personnel

Following is a proposed schedule for Math Lab S020 utilization:

1. Basic Skills Classes		hours/day	hours/week
M,W,F	8:00 a.m.-9:00 p.m.	13	39 hrs
T, Th	8:00 a.m.-11:30 a.m.; 1:30 p.m.-9:00 p.m.	11	22 hrs
Saturday	9:00 a.m.-12:00 p.m.	3	3 hrs

Thus, the Math Lab will have to be staffed by a clerk and a Basic Skills tutor for 64 hours per week to help with the competency-based individualized instruction. Estimated cost for this Laboratory-based class is:

Tutor - 64 hrs/wk at approx. $4/hr = $256/total wkly cost

Clerk - 64 hrs/wk
(Financial Aid student (1/5 x $3.50)) @ $.70/hr = $44.80

Salaries for Math Lab Personnel/Basic Skills Course:

Weekly cost for tutor + clerk = $300.80

Yearly cost (30 wks) cost for tutor + clerk = $9,024

2. Open-Lab Tutorial Center

Since a Mathematics Laboratory MUST, by definition, be OPEN to ALL students seeking help with ALL Mathematics courses and ALL Mathematics Related-Course material, provision must be made to have an additional Mathematics Tutor available during "Peak" hours. However, many of these students can be directed to the technological learning aids and supplementary materials available by the Clerk. Note that this implies that the preferred candidate for the Clerk Position will have a good Mathematics background in addition to being Financial Aid.

During "non-peak" hours, the OPEN-Lab student will have access to help from technological tutoring aids, limited contact with the clerk, and occasional one-on-one tutoring help from the Basic Skills tutor. However, since the Laboratory is well-organized and adequately supplied with teaching/learning aids, the lack of a special human tutoring component should not be sufficient reason to close the doors of the Lab.

The second Math tutor specifically assigned to the Open Lab should be available during the following "peak" hours:

	hours/day	hours/week
Mon., Tues., Wed., Thurs. 10:00 a.m.-2:00 p.m. and 5:00 p.m.-8:00 p.m.	7	28
Fri. 10:00 a.m.-2:00 p.m.	4	4
Sat. 10:00 a.m.-2:00 p.m.	4	4

The additional function of the Mathematics Laboratory plus College Hours on Tuesday and Thursday will add an extra eight hours per week or 240 hours per year (30 weeks) to the clerk's Basic Skills class time-schedule.

Estimated cost for the "Open-Laboratory" operation of facilities is:

	Total Weekly Cost
Tutor - 36 hrs/wk at approx $4/hr =	$ 144.00
Clerk - 8 hrs/wk at approx $.70/hr =	5.60

Salaries for Math Lab Personel/ Open-Lab "Tutorial" Center:

Weekly cost for tutor + clerk = $149.60
Yearly (30 wks) cost for tutor + clerk = $4,488.00

D. Balancing Tutor Budget 1985/86 Academic Year

The total yearly estimated cost for student personnel is $13,512. This figure is more than the allocated $11,000 budgeted. The discrepancy occurs because of additional Laboratory coverage

due to the dual function of the Laboratory. Note that additional money will be needed for tutors assisting in Basic Skills classes that do not meet in the Laboratory

IDEA: Seek a grant if the Department is willing to support the concept of Variable Credit, Open-Enrollment , and "Math Across the Curriculum" concept (my term). By the latter, I mean the introduction of modules that teach units on specialized Math topics such as Nursing Math, Math for Physics, Math for Chemistry, Calculators, Consumer Math, Math for Data Processing, Math and Hotel Management, Math needed for Art/ Music/ Choreography, Cryptography, etc. IDEA 2.; could try for a grant in COOP tutor training to help with teacher shortage.

E. Components of Math Lab, 1985/86

The first day of the Fall semester should find our Mathematics Laboratory system either fully equipped with the following materials or with plans, skeletal compilation or at least the organization necessary for growth to a well-run Open Lab program.

*Available in Department at present
**Must be available (either by writing or purchasing, organizing, etc.) by Fall, 1985.

1. Human component

*a. Teacher acting as
   1. Manager
   2. Major teaching device
      a. Lecturer
      b. Discussion leader or tutor with small groups or individually.
      c. Evaluator

*b. Teacher Aides (tutors) assigned to class and Open Lab on a regular basis. See pp. 4 - 5 for details.

*c. The learner himself/herself. Not only does he/she provide the internalized changes that are his learning but contributes to his own learning and that of others as a

   1. Questioner
   2. Discussant
   3. Classroom (lab) manager
      a. Leader in small group work
      b. Tutor as partner of less-able student
      c. In lab, he may
         1. Select material he will use.
         2. Decide which of several modes of instruction he'll use.
         3. Choose the strategy or medium of instructions he/she prefers.

4. Decide which non-basic objectives he will achieve or which parts of basic instruction he/she needs to concentrate more time and effort doing.
5. Proceed at his/her own rate achieving Mastery Level attainments as he proceeds.

** d. Visiting Lecturers

2. Printed Medium Components

For Teacher Use: *Textbook and Accompanying Teacher's Manual
*,**Alternate Texts
*,**Background Books
*,**Pictures
*,**Diagrams and Charts
*,**Spirit Duplicate Masters (Prepared & Blank)
*,**Diagnostic Tests
*,**Achievement Tests
*,**Math/teaching magazines

For Student Use: *Textbook
*,**Teacher-prepared printed material (SSG, Supplementary practice sheets, explanations etc.)
*,**Workbooks for additional drill
*,**Alternate Texts
*,**Books about Math (Applications, Mathematicians, Careers, etc.)
*,**Practice Tests

3. Audio/Visual Components

*,**a. Chalk and Chalkboards (Built into North wall and wheel-i
**b. Overhead projectors and transparencies
**c. Slides
**d. Filmstrips
**e. Films
*f. Audio Tapes
*g. T.V.'s
*,**h. Computers, Calculators.
*,**i. Computer Software
**j. Models, Manipulative Devices, and Games
**k. Screen on Tripod

4. Furniture

**25-30 Carrels for class area.(I favor all wet - i.e. equippe with electrical outlets, screens, T.V. equipment).
**6 computer carrels for open-lab.
*Our tables in Math Lab (Pentagon shape).
**Blue/Green cloth chairs.
**3 desks and chairs.
**Time clock.
**Large filing cabinet for student files.
**2 smaller filing cabinets for supplementary typed material.
**Blackboard for office.
**10 Carrels for Open-Lab space

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4. Furniture (con't)

**Card catalogue for Lab inventory.
**Disk filing cabinet.
**Pencil sharpener.
*Bulletin Boards.
*Shelving.

II. Handouts Available Concerning Procedures Related to:

1. Tutors

*a. Application for Tutor position
*b. Attendance
*c. Evaluation
*d. Training Program Objectives
*e. Coop Seminars planned
*f. Orientation Workshop

2. Test-taking Schedule (Arithmetic & Elementary Algebra)

3. Audio/Visual Equipment

*a. Sign In/Out Sheet for Tape-Player, Headphones, Audio Cassettes, Video Cassettes.
**b. Sign In/Out Sheet for Computer Software.
*c. Card catalog for:
1. Audio-Tapes
2. Video-Tapes
3. Computer Software
4. Overheads
5. Supplementary Handouts
6. Supplementary Books

4. Administrative Procedures

a. Math Lab Classroom Usage Schedule indicating Open-Hours
b. Tutor Assignment Schedule
c. Tutors Employed to-Date with Phone #'s
d. Test Taking Forms (For New Math Teachers)
e. Two-Session Orientation for Math Lab/Basic Skills Teachers - Facilities utilization plus PSI.

The flow-chart in Appendix shows a classroom system flow-chart for teaching a topic in mathematics within an overall sequence of topics.

Conclusion:

Programs using the Open Lab concept for all courses find that they meet the increasing demands of more and more students with an economically sound program. It has been found that labs operate at one-third of the cost per credit hour than by traditional classroom methods.

Conclusion (con't)

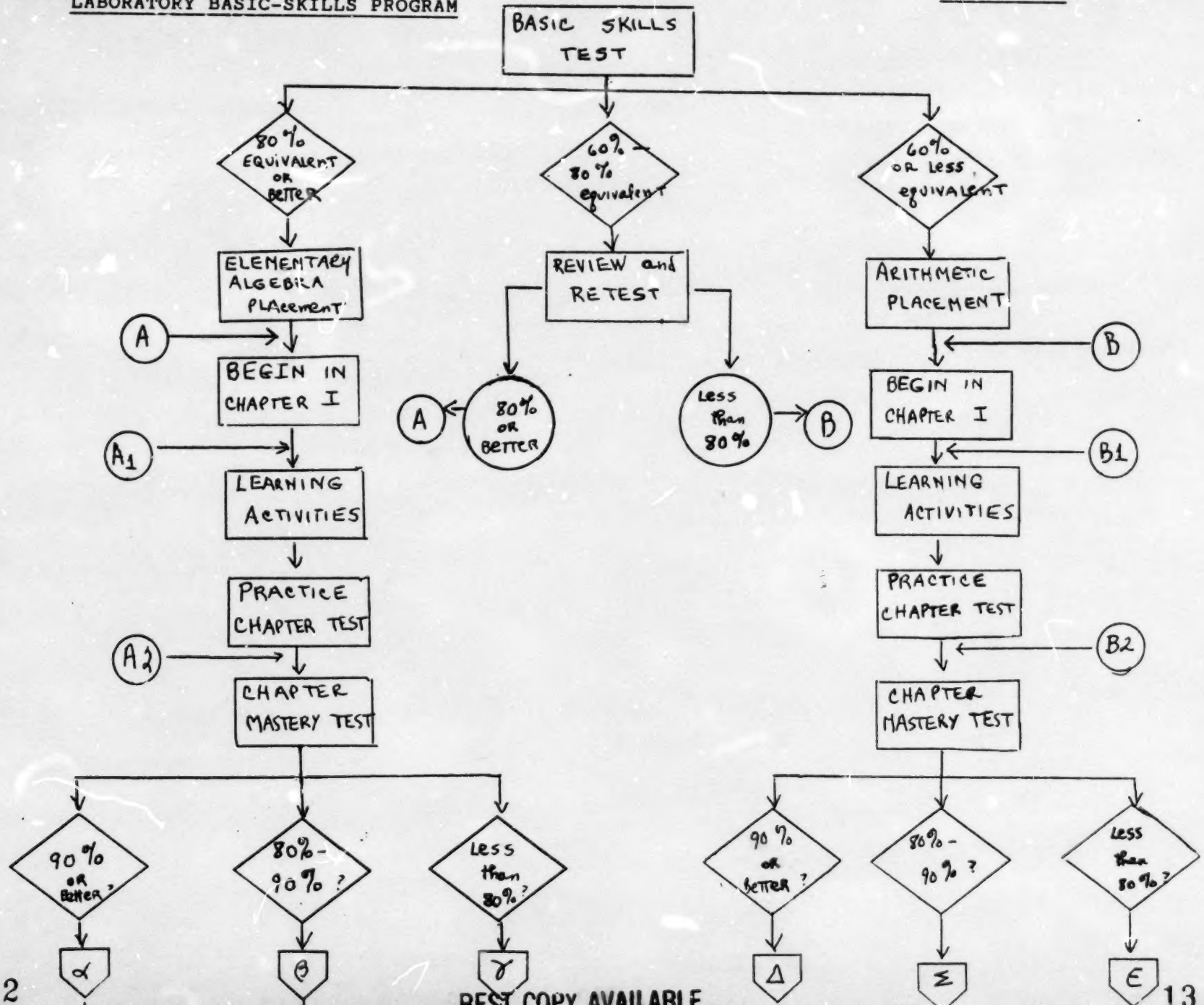
The laboratory system involves more work on the part of the instructor. There is much record keeping and filing in addition to the many papers to grade and team-meetings to standardize policies.

However, there is no homework for anyone but the coordinator. The Coordinator is responsible for:

1. Test replacement and changes in the program with the approval of the Mathematics Department.
2. Maintaining complete sets of tests to be used for replacement if the need arises.
3. Keeping an up-to-date record (computer) of each student's progress in the lab and attendance in the lab.
4. Keeping a folder file-system for each student in which his/her work is filed after it is posted to his/her record card. These folders are kept for diagnostics throughout the student's college career.
5. Maintaining a card-catalogue (computer) of all software/hardware/handouts/overheads/books/etc. available for student/teacher use.
6. Initiating Workshops and or Modules in "Math Across the Curriculum" as need arises.
7. Supervising Tutors and Clerk.
8. Responsible to Math Department Chairman for providing leadership and coordination of all math teaching and tutoring done in the Laboratory environment.

STUDENT STUDY PATTERN IN
LABORATORY BASIC-SKILLS PROGRAM

APPENDIX A



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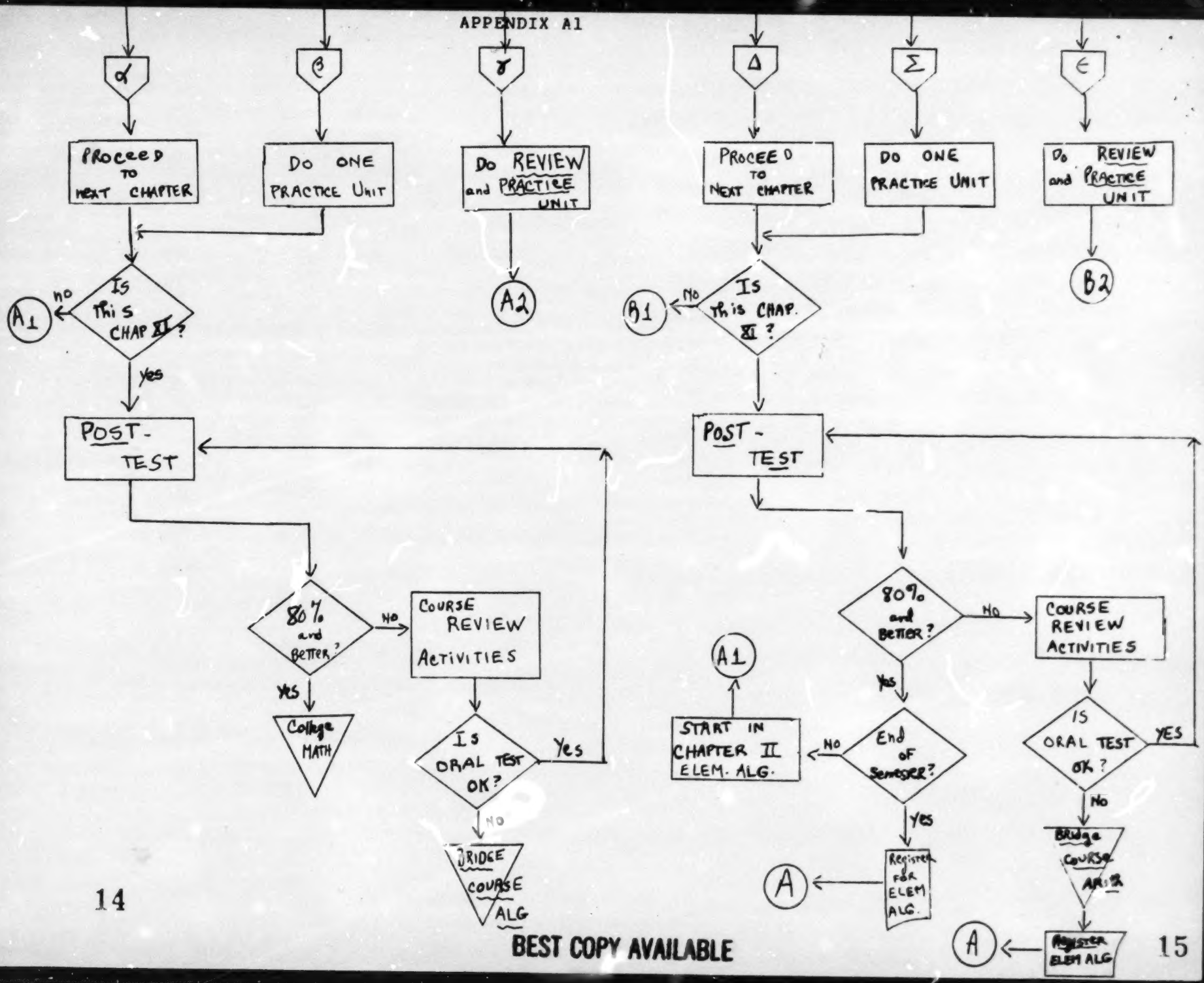

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APPENDIX B

QUESTIONNAIRE FOR TEACHERS INTERESTED IN
TRYING PSI SYSTEM DEVISED BY
FRED S. KELLER

1. Are you willing to let everyone know exactly what you are teaching- what is in your assignments, your study questions, and your tests?

2. Is your desire to have your students learn as great as your desire to display your knowledge or your special skills?

3. Are you willing to give an A to every student who meets the stated requirements of your course regardless of his/her IQ, his GPA, or the time that it takes to do the job?

4. Are yor willing to let the A-performers in a course help you under careful supervision, to evaluate the work of other students?

5. Are you willing to make use of detailed feedback provided by these students on every aspect of your course, in evaluating your tests and assignments?

6. Are you ready to take a certain amount of sniping from your colleagues with respect to what you are doing and your reasons for doing it?

7. Are you willing to follow closely a teaching prescription prepared by someone other than yourself?

8. Are you against the notion that because you are the product of a certain teaching system it must be mainly good?

9. Are you willing to spend more time than you used to in connection with your course, if you are aware that your students would like it better?

10. Do you believe that you are currently a FAILURE as a teacher?

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